

2421 *Empoasca mali* (Le Baron) (9 specimens).

July–August, '17–'18.

2422 *Empoasca flavescens* (Fabricius) (1 specimen).

July 31, '17. First record for New Jersey of this widely distributed species. *Empoasca* sp. (1 specimen). July 31, '17 (perhaps same as preceding).

2430a *Empoa querci* var. *gillettei* Van Duzee.

Empoa bifasciata Gillette and Baker.

July 12–20, '17. Although there is hardly a trace of the crossbands in some of these specimens it is possible that all four belong to the above mentioned species.

THE LIFE HISTORY OF *THANAOS FUNERALIS* SCUD. & BURG. (LEPIDOPTERA; HESPERIIDÆ).

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Thanaos funeralis is a common butterfly in Southern California, ranging eastward into Arizona, Texas and Colorado. In the vicinity of Los Angeles it is one of the earliest butterflies of Spring, appearing sometimes during the first week of February, but normally is not out in full force until the middle of March.

It is here triple brooded, the first brood waning about the middle of April and disappearing in early May. From the middle of May until late in June members of the second flight are emerging, and in late August and September those of the third appear. As with other species of *Thanaos* that are double or triple brooded, the first brood is by far the largest in point of numbers, the third brood especially being a scanty one. I have found but three food-plants:

FABACEÆ.

Hosackia glabra Torrey. Deerweed. This is the usual food-plant, all three generations using it.

Medicago sativa Linn. Alfalfa. I have noted examples of the fall generation ovipositing on this plant.

HYDROPHYLLACEÆ.

Nemophila membranacca. Snow Flakes. In Chino Canyon, on the Colorado Desert, members of the first brood were found ovipositing on the upper surfaces of the leaves.

The eggs are usually deposited on the under surfaces of the leaves, occasionally on the upper, and sometimes even on the stem. Though a swift and wary species, the females of *funeralis* when ovipositing become so intent upon their maternal performances that they are quite oblivious to any movement about them, and while examining a sprig of *Hosackia* I have had a female alight on it and deposit an egg even while I was endeavoring to capture her with my hand. In hatching the young larvæ eat out irregular jagged holes in the summits of the eggs, only devouring sufficient of the shell to make their escape. Following is a time record of the transitions:

- Eggs laid April 13th.
- Hatched April 22d.
- Larvæ passed first moult April 27th.
- Larvæ passed second moult May 4th.
- Larvæ passed third moult May 9th.
- Larvæ passed fourth moult May 14th.
- Larvæ pupated May 19th.
- Imagoes emerged June 14th.

The newly hatched larvæ are exceedingly active, scampering about anxiously until locating leaves that meet with their full approval. In the first instar the larvæ seem to attack only the surfaces of the leaves, both upper and lower.

In the later stages the usual type of *Thanaoid* nest is constructed, and the larvæ feed mainly—perhaps in Nature entirely, by night. Pupation occurs in the last larval nest.

Whether, as in Eastern species of *Thanaos*, the larvæ of the first brood destined to produce the generation of the following spring, hibernate in the last instar is a point I have not been able to settle, as all the larvæ I have procured pupated and emerged as the second brood. So too, whether the larvæ of the second and third broods hibernate is problematical.

Scudder (Butt. New Eng., Vol. 2, p. 1449, 1889) states of the larvæ of *Thanaos* that the apically expanded bristles of the earlier instars are replaced by short sharp hairs upon the assumption of the fourth

stage; but this does not hold true of *funeralis*, in which the fungiform hairs persist to pupation.

The Egg.—Subspherical, the base squarely docked, the sides narrowing upwards only slightly except towards the extreme summit, which is rather broadly rounded. A series of rather high, compressed longitudinal ribs, pellucid, ranging from base to, or nearly to, the micropyle depression in a slightly sinuous course. These ribs .12 mm. equidistant in the middle and .03 mm. in height. Between them a series of delicately raised cross ribs, .02 mm. apart, straight, and where they strike the main ribs they give to them a beaded appearance. The surface between the longitudinal ribs gently concave, minutely punctate. The longitudinal ribs varying in number, from twelve to sixteen. The micropyle in a flat slight depression, .14 mm. in diameter, consisting of a minute circular central cell bounded by large roundish-oval cells, and still larger oval-angular cells surrounding these. The minute central cell, .005 mm. in diameter; the surrounding roundish-oval cells, .01 mm. in length; the larger oval-angular cells, .018 mm. Surface of egg covered with a multitude of excessively fine roundish raised cells, quite uniform, .002 mm. in diameter. Color, when first laid, a very pale green, almost white. Changing in about forty hours to a distinct lemon yellow, and after forty-eight hours more to a conspicuous orange, with the longitudinal ribs remaining a saffron yellow; finally, just before hatching, to a deep brown. Height, .64 mm.; broadest in the middle of the lower half, .66 mm.; breadth at base, .56 mm.

First Instar.—Head and body uniform orange brown. Head, .44 mm. in diameter, orbicular, roughly granulated, and bearing some simple scattered tapering and apically expanding hairs, about .06 mm. in length; ocelli black. The dorsal shield of first thoracic segment small and obscure, a slight shade darker than the body. On the body there are four series of apically expanding bristles, as follows: An infrastigmatal series, one to a segment on the thoracic segments, placed in the middle; two to a segment on the abdominal segments, one placed before and one just after the middle of the segment. Those of the abdominal segments .04 mm. in length, and with the tips .02 mm. in diameter; those of the thoracic segments a little longer and less expanded at the tips. A suprastigmatal series, situated directly above

the spiracles, two each on the thoracic segments, placed close together, but only one on each of the abdominal segments. A lateral series, one each on all the segments, placed posteriorly. A supralateral series, one to a segment, placed anteriorly on the abdominal segments, but posteriorly on the thoracic, where they tend to become subdorsal. The bristles of these last three rows shorter than those of the infrastigmata, being only .02 mm. in height, with the expanded tips .025 mm. in diameter. Length, 1.6 mm.; width at first thoracic segment, .32 mm.; width at anal segment, .24 mm.

Second Instar.—Head now pitchy black, .70 mm. in diameter, roughly corrugated, but slightly bilobed. Head studded with numerous short-crooked clavate hairs, white, thickly but minutely spiculiferous, and but .03 mm. in height. Dorsal shield of first thoracic pale green, smooth, without hairs. The body studded with short white hairs of the same nature as those of the head, and of the same length. The segmental folds of each segment distinct. Color of body a uniform bright lemon yellow, but as the stage develops a more and more greenish coloration is assumed, until finally the lemon yellow is completely obscured by a green almost the exact color of the upper surfaces of the leaves of *Hosackia*. Ventral surface and prolegs concolorous with body above. Legs semi-opaque, very pale yellow. Length, immediately after first moult, 3. mm.; width at first thoracic segment, .60 mm.; width at anal segment, .42 mm.

Third Instar.—Head, 1.34 mm. in diameter, but slightly bilobed, corrugated, piceous black, thickly studded with irregular filament-like white hairs, .05 mm. in length on the average. Fore part of first thoracic segment smooth, pale yellow. Dorsal shield gray green. Body thickly covered with white hairs, tipped at the ends with saucers. These hairs but .03 mm. in height and of the same diameter at tips, and arranged in fairly regular transverse series. The tubercles from which these body hairs arise pale yellowish green. A few long sharp white hairs fringing the anal segment, these .20 mm. in length. Color of body greenish yellow. A dark green dorsal line. A trace of a greenish white lateral line, narrow, and not sharply defined. Spiracles pale straw yellow, suboval, inconspicuous, .03 mm. in diameter. Ventral surface and prolegs concolorous with body above. Legs semi-opaque, pale yellow brown. Length, 6.10 mm.; width at first thoracic, 1. mm.; width at anal segment, .94 mm.

Fourth Instar.—Head, 2.04 mm. in diameter, piceous black, but slightly bilobed, heavily corrugated. As before, head densely studded with spiculiferous filament-like white hairs, now .08 mm. in length on the average. Fore part of first thoracic segment greenish yellow, smooth. Dorsal shield green. As before, body profusely studded with fungiform white hairs, arranged in more or less regular transverse series. These hairs are now .04 mm. in height, .03 mm. in width at the saucer-tipped ends, and arise from pale green-yellow tubercles. Some of the fungiform hairs, especially along the posterior edge of the anal segment, are as long as .10 mm. Anal segment with some long fine sharp hairs, white and spiculiferous, some as long as .28 mm. Color of body grass green; the segmental sutures yellow, giving as a whole a blotched yellow-green coloration to the body. The lateral line narrow, greenish white, not distinct nor prominent, but developing more and more strongly as the stage proceeds. A greenish-white stripe, indistinct and crenate, along subventral ridge. Spiracles sub-oval, pale straw yellow, inconspicuous, .04 mm. in diameter. Ventral surface and prolegs concolorous with body. Legs pale yellow brown. Length, just after moult, 9. mm.; width at first thoracic, 1.70 mm.; width at anal segment, 1.40 mm.

Fifth Instar.—Head 3.70 mm. in diameter, well rounded, subquadrate, the sides fully rounded, the summit laterally angulated and forming by a slight median excision of the center a slightly elevated laterad submamillate prominence. Head in color brown black, but this coloration is obscured in the following way: A conspicuous orange blotch on either upper prominence; this is scarcely interrupted by a frontal crescent of the ground color of head from a second, but slightly smaller orange spot laterally on each side of face; below this, on the lateral front corner of face, a third smaller roundish concolorous spot. These three spots may be more or less confluent, but in most individuals are distinctly separated. Sometimes a still smaller fourth spot, roundish and of the same color, on the lower lateral posterior angle. Ocelli black fuscous; labrum, base of antennæ and labium pale. Head strongly vermiculate with short white hairs arising from minute pale tubercles; these hairs plumose, varying slightly in size, but average .12 mm. in length. Only a few low inconspicuous red-brown tubercles on summit of head laterally, these but .03 mm. in height. Body largest

at 3d, 4th, and 5th abdominal segments, tapering with considerable uniformity in either direction, but more rapidly at the extremities. Last abdominal segment well and rather strongly rounded. As before, body studded with fungiform white hairs, of slightly varying sizes, arising from rounded pale green-yellow tubercles arranged in more or less regular transverse rows. The largest of these hairs but .10 mm. in height, and .05 mm. in diameter at their saucer-tipped ends. Anal segment with a posterior fringe of fine sharp colorless spiculiferous hairs, of varying sizes, some as long as .40 mm., others but .14 mm. The segments of body divided into four subsegments, the anterior one much the widest, covering the whole half of segment, as wide as the other three together. The other three subequal and occupying posterior half of segment. The broad anterior subsegment with a dorsal division separating off a posterior portion of same width as hinder sections. A laterodorsal series of chitinous annuli, placed in middle of anterior half of each segment, smooth, dark green, .08 mm. in diameter. A laterostigmatal series of similar annuli placed directly above the stigmata, slightly smaller than the laterodorsals, but .05 mm. in diameter. A ventrostigmatal series, two to a segment near together, one in advance of the middle and the other a little behind the middle. Spiracles long oval, pale straw yellow, but slightly elevated, inconspicuous, .12 mm. in diameter. Color of body pale green, yellowish in all the wrinkles, and with a pale-yellowish bloom to all the surface, caused by the profusion of minute hairs. The dorsal line not prominent, fine, even, dark green. The lateral stripe fine, even, white or very pale yellow, fairly conspicuous. As the stage develops this line is slightly interrupted on the abdominal segments with a small blotch of orange, consisting of two fine vertical streaks, close together, on the segmental sutures. But this lateral line tends to become subobsolete on the thoracic segments, sometimes being but faintly represented, then again wholly lacking, and is usually also wanting on the last abdominal segment. A subventral yellowish stripe, even, narrow, not very prominent. First thoracic segment pale yellowish, smooth, hairless. Ventral surface a rather brilliant blue; legs pale yellow green, slightly infuscated at their tips; prolegs pale green. Length, just after moult, 17. mm.; at maturity, 24 mm. Width at first thoracic segment, 2.80 mm.; at anal segment, 2.10 mm.

Pupa.—Of the usual generic type. In color a vivid green, but with the wing cases and sometimes the abdomen clouded with creamish. The whole body, excepting the wing cases, but especially on the anterior half, covered with pale tapering wavy sharp hairs, .30 mm. in length on the average. Prothoracic stigmata prominent, velvety black. The cremastral spine pyramidal, truncate, longitudinally and irregularly sulcate; the cremastral hooklets .30 mm. in length, stout, castaneous. Spiracles long oval, .20 mm. in length, .08 mm. in their greatest width, with a slightly fuscous areola; the spiracles not at all prominent. The tongue case only very slightly extending beyond the tips of the wings. Length, 18.5 mm. Greatest height of thorax, 5.5 mm.; greatest height of abdomen, 4.7 mm.; width at eyes, 4.5 mm.; width at basal wing tubercles, 5.5 mm. Suspended by a median girdle, very loose but strong, and a Y-shaped posterior attachment.

THE IMMATURE STAGES OF THE CATNIP LEAF-HOPPER (*EUPTERYX MELISSÆ* CURTIS).

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On October 27, 1919, the writers found a small patch of catnip (*Nepeta cataria* L.) on Inner Brewster Island in Boston Harbor. The plants were infested by a small leafhopper which was present in all stages in great abundance. The feeding of the insects had resulted in a characteristic yellowish-white discoloration of the leaves and injury to the plants was becoming apparent. Some of the infested material was collected and brought to the laboratory where the several nymphal stages were readily separated.

Eggs were found in considerable abundance in the petiole of the leaves. They were inserted at a slight angle or nearly parallel with the petiole, the cap apparently being flush with the surface. Egg-punctures could be readily distinguished by means of a small brownish discoloration of the epidermis.

Adults were submitted to both Prof. Herbert Osborn and Mr. W. L. McAtee who identified them as *Eupteryx melissæ* Curtis, as understood by McAtee (*Ent. News*, 30: 182-183, 1919).

Little is known of the life-history or habits of this species. The